Long Acting Single Injection Caudal Anesthesia

1,208 Obstetrical Deliveries with Mepivacaine

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■ *Long acting, single injection caudal anesthesia with mepivacaine was studied in 1,208 obstetrical cases.*

A 1 per cent solution was used in 671 patients and compared with a 1.5 per cent concentration in 537. No remarkable differences were found between the two groups. The 1 per cent solution provided relief of labor discomfort for from 60 to 180 minutes with an average of 110 minutes. In contrast, the 1.5 per cent solution provided an average of 115 minutes with a range of 80 to 210 minutes.

A total volume of 30 ml of anesthetic agent yielded anesthesia to a level of the tenth thoracic vertebra or higher in 91 per cent of patients.

Significant alterations in blood pressure were uncommon. About 1 per cent of patients required a vasopressor because of a drop in systolic blood pressure below 80 mm of mercury. Another 8 per cent had a drop of over 20 points in systolic pressure but from high enough levels that they did not require a vasopressor.

Toxic effects similar to those of lidocaine were found in slightly more than 1 per cent of cases.

This anesthesia requires a higher incidence of operative intervention for delivery.

LONG ACTING single injection caudal anesthesia utilizing mepivacaine* was studied in 1,208 obstetrical cases at the 2796th USAF Hospital. Two concentrations were compared. A 1 per cent solution was used in 671 patients and a 1.5 per cent solution for the remaining 537. The safety and efficacy of the drug have been demonstrated in all varieties of forceps deliveries, obstetrical manipulations, immediate postpartum tubal ligations and emergency cesarean sections. The broad applicability of this technique is confirmed by its use in 87.5 per cent of the 1,381 total number of deliveries during the study.

Mepivacaine is a highly stable amide, chemically related to lidocaine and with similar toxicity. However, it has the advantage of longer duration of action. It can be autoclaved repeatedly and stored indefinitely. Its most remarkable characteristic is that little apparent vasodilatation occurs with its use; hence significant cardiovascular changes are rarely experienced.[1,2,3,6]

Technique

The following technique is consistently employed regardless of the patient's height, weight or obstetrical situation. Whenever possible the anesthetic is administered early in the acceleration phase of labor. With the patient in the left lateral

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Submitted 30 June 1966.

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*As Carbocaine,® supplied in part by Winthrop Laboratories, New York.

recumbent position, with the right hip and knee flexed, the sacral area is prepared and draped. In the average case we prefer to use a No. 19 two-inch-long malleable Hingson-Edwards needle. A longer needle may be necessary for extremely obese patients, whereas in thin patients with good landmarks an ordinary No. 21 hypodermic needle may be used. The needle is inserted 2 to 3 cm through the sacral hiatus and then connected through approximately 20 cm of rubber tubing to a syringe. This flexible system provides adequate stabilization of the needle with minimum risk of entering the dura. In only two instances during this study was the dura punctured. In both cases, from the free flow of spinal fluid it was felt that the dura came low down in the caudal canal in an anomalous fashion. Accordingly, no anesthetic agent was injected.

Proper placement of the needle is suggested by free injection of 5 to 10 ml of air while the anesthetist's hand palpates over the lumbosacral area to confirm absence of crepitus. A 5 ml test dose of mepivacaine in Ringer's solution is then injected. After elapse of two or three minutes rectal examination is done to demonstrate sphincter relaxation and to palpate the ventral surface of the sacrum and coccyx. This helps to confirm proper placement of the needle and also prevents the unfortunate complication of injecting the anesthetic solution into the fetus. Assuming no associated signs of spinal anesthesia appear within four minutes of observation, an additional 25 ml of anesthetic solution is then given, with aspiration several times during injection to assure against inadvertent spinal or vascular administration. By avoiding scraping the needle against the bone and inserting only a short distance, vascular absorption may be reduced. We deprecate the practice of deliberately scraping along the canal in order to induce bleeding as evidence of proper placement. A sensation of pressure in either or both buttocks, with radiation down the posterior aspect of the leg (sciatic sign), was noted by 80 per cent of the subjects. This sensation is an excellent indication that the injection is in the caudal canal. Because vasodilatation is not pronounced the "warm foot sign" is not as apparent as it is in caudal anesthesia when metycaine or lidocaine is used.

Immediately after injection the needle is withdrawn and the patient placed supine to promote an even level of anesthesia bilaterally. Blood pressure is monitored carefully for the next 30 minutes. In most cases discomfort is relieved within five to 10 minutes, but the maximum level of cutaneous analgesia may not be attained for at least 15 minutes. After the 30-minute observation period, the patient may be observed as to vital signs just as any other patient in labor, since any significant change resulting from anesthesia will occur within this time.[4,5] This does not mean the attendants are relieved of the burden of judicious observation of the patient's progress, but simply that significant alteration in vital signs after this time must be accounted for by other factors.

Duration

Because of its long duration, a single injection provided adequate anesthesia for the remainder of labor and delivery in 91 per cent of the patients in the study. The remaining 104 patients received from two to four injections each by repeat puncture, in order to suitably prolong anesthesia through delivery. In the group for which 1 per cent mepivacaine was used, there were 55 patients requiring 71 such injections. The duration of anesthesia until it was necessary to repeat it ranged from 60 to 180 minutes, and both the mean and the median duration was 110 minutes. In contrast, 49 of the patients given 1.5 per cent mepivacaine required a second injection to carry them through labor to delivery. In this group the duration of the first injection ranged from 80 to 210 minutes with a mean time of 115 minutes and a median of 110 minutes. Because there is so little difference between the two groups, we prefer the 1 per cent concentration for routine use, since theoretically the risk of toxic reaction is less. With either concentration perineal anesthesia generally persisted about 45 minutes longer than anesthesia at the high level necessary for relief of uterine contractions, thus providing ample time for repair of episiotomy or lacerations. The longest total duration of anesthesia was 8 hours and 15 minutes in a primagravida who received four such injections of 1 per cent mepivacaine.

Level of Anesthesia

All data were analyzed separately according to the strength of anesthetic solution. However, where no significant differences were found the two groups were combined for simplicity of presentation.

The level of anesthesia is primarily dependent upon the volume of anesthetic solution injected rather than its concentration. The patient's height,

weight and gross skeletal structure did not correlate well with the level of anesthesia attained using the standard 30 ml dose. The 30 ml injection provided anesthesia to the level of the tenth thoracic vertebra or higher in 91 per cent of cases. A level below this was generally inadequate to relieve labor pains completely; hence, when circumstances permitted, a supplementary injection was given by repeat puncture to raise the level. The ideal level —from the tenth to the eighth thoracic vertebra— was achieved in 77 per cent, while a level from the second to the fourth occurred in only 2.5 per cent. A high level did not cause any particular problems.

Circulatory Changes

Significant alterations in blood pressure were quite uncommon (Table 1), with little difference between the 1 per cent and the 1.5 per cent series. A vasopressor agent was required in only 1.5 per cent of the patients in whom the 1 per cent mepivacaine solution was used and in only 0.6 per cent of patients given the 1.5 per cent solution. This paradoxical finding occurred because most cases in the 1 per cent group were fairly early in the study, before we became alert to the increased tendency for patients in labor to demonstrate the supine hypotensive syndrome after caudal anesthesia. Probably several of those patients would have responded to turning on the side and would not have required a vasopressor agent.

In the 107 patients of both series who had a blood pressure drop of over 20 mm of mercury, the systolic pressure remained over 80 and the average lowest systolic pressure was 94 mm of mercury. Many of these patients started with blood pressure somewhat elevated from their normal ranges because of the anxiety and pain of labor. In such cases, the fall in pressure cannot be attributed entirely to a hypotensive affect of the drug or to sympathetic block. As our awareness of the supine hypotensive syndrome increased, we found that more and more of the blood pressure drops could be counteracted by the simple expedient of turning the patient to the side, increasing venous return to the heart. Among the other patients with pronounced drop in blood pressure the intravenous administration of 3 to 5 mg of methoxamine resulted in prompt return to normal levels. In only one patient did the blood pressure fall abruptly to a level at which it could not be determined. This occurred five minutes after the usual dose of 1 per cent mepivacaine. The patient responded immediately to methoxamine with no adverse effect either to her or to the fetus.

One other bizarre response was found in a patient given 30 ml of 1 per cent mepivacaine, plus a supplement of 20 ml to raise the level of anesthesia from the twelfth to the seventh thoracic vertebra. Shortly thereafter, her blood pressure dropped to 70/40 mm of mercury associated with bradycardia, 40 beats per minute. The hypotension responded promptly to administration of methoxamine but the bradycardia persisted for approximately 15 minutes before spontaneously returning to the patient's normal rate of 72.

Toxicity

Overdosage or faulty administration resulting in a high blood level of mepivacaine will produce toxic effects similar to those of lidocaine. In this series 15 patients showed evidence of intravenous absorption manifested by a subjective sensation of anxiety and a feeling of impending disaster followed by varying degrees of tinnitus. In all cases this lasted only a few minutes and resolved without treatment. One patient became disoriented and showed athetoid movements of the arms for about one minute, but also had resolution of the symptoms without treatment. There were no instances of unconsciousness, convulsions or precipitous change in vital signs in these patients.

No instances of infection or local tissue reaction were observed in this series. Allergic reactions were not found. No instances of fetal distress or of maternal or fetal morbidity could be attributed to this anesthesia.

Method of Delivery

Provided labor is well established, there is no

TABLE 1.—*Blood Pressure Changes in Patients Given Mepivacaine Solution for Caudal Anesthesia*

Systolic Blood Pressure (mm of mercury)	*Strength of Solution*			
	1 Per Cent Mepivacaine		*1.5 Per Cent Mepivacaine*	
	No.	*Per Cent*	*No.*	*Per Cent*
Over 10 rise	16	2.4	17	3.1
10 ±	452	67.4	343	64.0
10-20 fall	131	19.4	123	23.0
20 fall, systolic remaining over 80	60	9.0	47	8.6
Vasopressor, systolic under 80	10	1.5	3	0.6
No vasopressor, systolic under 80	2	0.3	4	0.7
Total	671	100.0	537	100.0

apparent tendency for early administration of this anesthesia to retard its progress; on the contrary, it is the authors' impression that it speeded and enhanced progress. As would be expected, duration of labor was somewhat longer in primagravidas, and the caudal agent was administered to them somewhat later in labor than in multigravidas. Obstetricians using caudal anesthesia can generally expect to resort more often to operative interference in order to effect delivery. This results from blocking the reflex to bear down in the second stage when the fetal head reaches the pelvic floor. Furthermore, the decided perineal relaxation tends to inhibit spontaneous rotation of the head to the occiput anterior position. With the level of anesthesia in the range of the tenth to the eighth thoracic vertebra, there will usually be sufficient strength in the abdominal musculature to permit cooperative patients to bear down with contractions to promote spontaneous delivery. Many obstetricians, however, would share the author's preference for the use of forceps for delivery. The high incidence of mid-forceps delivery (Table 2) reflects the need for rotation, usually at a low level in the pelvis. We did not feel there was any increased loss of blood associated with this anesthesia.

Contraindications

We feel that the only major contraindications are infection at the injection site or the patient's refusal. The authors believe this technique can be successfully applied in almost any obstetrical situation. Monstrous obesity presents only a minor problem to experienced operators; caudal anesthesia was successfully given to a number of patients in this series whose weight exceeded their ideal by over 150 pounds. There were only eight instances during the study period when the authors were unable to properly place the caudal needle and these were primarily in situations where time did not permit more than one attempt.

It was desired to maintain a simple yet effective regimen of analgesia for the patients in this study. Labor was induced in 39 per cent, all of whom were given 100 mg of secobarbital orally about two hours before starting the induction. Early in labor meperidine (Demerol®) from 50 to 100 mg was given intravenously to 88 per cent of the primigravidas and 50 per cent of the multiparas. We were usually successful in gauging the administration of the narcotic to be one to two hours before administering the caudal injection, and the effects of these medications were well established by the time the caudal injection was made. Thus, confusion as to what changes were produced by the anesthesia and what by premedication was avoided. This proved valuable in providing relaxation and cooperation at the time of administering the caudal while providing ample time during the remainder of labor for the narcotic to be metabolized. As a result evidence of fetal respiratory depression was extremely rare.

Nausea was experienced by 12 per cent of the patients and 7 per cent vomited. There was no significant correlation between vomiting and the total dose or concentration of mepivacaine used. Because of the frequent occurrence of nausea and vomiting in labor it is doubtful that the incidence reported here should be regarded as a significant effect of the anesthesia.

Evaluation of Anesthesia

Besides our preoccupation with the broad spectrum of pharmacologic effects in anesthesia, we must keep in mind that the basic reason for its administration is the relief of pain. In this respect caudal anesthesia appears to be unexcelled in obstetrics. In the present series the physician rated the anesthesia excellent in 1,180 cases or 97.7 per cent (Table 3). In these patients there was complete relief of the discomfort of labor as well as complete routine manual extraction of the placenta and perineal repairs. In 19 cases it was rated only good by the physician, largely because of a low initial level or falling level of anesthesia at the time of delivery. In nine cases it was rated only fair, usually because of a very low or unilateral level. Four of these patients showed a spotty pattern of anesthesia which could not be eliminated by supplementary injection; and in these cases there was a decided flow of blood when the caudal needle was inserted. It is postulated that there may

TABLE 2.—*Method of Delivery*

	Primagravida		*Multigravida*	
	No.	*Per Cent*	*No.*	*Per Cent*
Spontaneous	46	11.0	384	48.2
Low	236	55.6	275	34.5
Mid	124	29.2	110	13.8
Breech	12	2.8	17	2.1
Version	2	0.5	8	1.0
Cesarean	4	0.9	3	0.4
Total	424	100.0	797	100.0

*Includes 13 sets of twins.

have been blood clotting in the caudal canal, preventing the usual effect of the anesthetic agent.

For the most part the patients were also pleased by this anesthesia, 94 per cent rating it excellent. It was considered only "good" by 3.7 per cent even though they appeared to have complete relief of pain. Because of some persisting discomfort associated with a low or falling dermatomic level, it was rated only fair by 1.5 per cent. Only ten patients or 0.8 per cent actually disliked it. Their aversion appeared to be related more to their emotional response to pregnancy and delivery than to adequacy of anesthesia. These patients generally wanted to be asleep.

Advantages

We feel that for general use in obstetrics, the regimen reported herein has specific advantages over other forms of anesthesia, over other techniques for administering caudal anesthesia and over other drugs used in caudal anesthesia. The specific advantages of mepivacaine are long duration and low toxicity.

With this drug the simple single injection technique can match the relief provided by the continuous technique in the vast majority of patients without the inconvenience or adverse psychological effect of having a catheter or needle left in place throughout delivery. In those cases of inadvertent total spinal anesthesia of which the authors have direct knowledge, all occurred upon subsequent injections when a continuous technique was used. When a catheter or needle is left in a patient, there is a risk of dural penetration when she moves. If the patient is left in a lateral recumbent position, unequal levels of anesthesia are commonly found. If the patient in labor is placed in the supine position with a catheter or needle in situ, contamination with rectal contents is almost unavoidable, particularly with patients in labor who have been given an enema.

Finally, we must consider the advantage over other varieties of anesthesia. The inherent dangers of fetal depression and possible accident to the mother associated with general anesthesia are so well known that the superiority of regional anesthesia of any type need not be extolled. We prefer caudal anesthesia over the currently popular combination of paracervical and pudendal blocks because a more extensive area is anesthetized for a significantly longer time with a significantly smaller amount of anesthetic agent. There seems to be much less risk of technical error or of excessive vascular absorption with a single caudal injection than there would be from multiple injections into vascular areas as with paracervical and pudendal blocks. In comparison with saddle block, which is simple and effective, caudal anesthesia has the great advantage that it can be administered far earlier in labor. As a result the patient can be effectively relieved of pain throughout the most difficult part of labor and delivery with minimum use of narcotics. In addition, with caudal anesthesia the physician can work at a relatively leisurely pace, much more at his convenience, and have a more alert and cooperative patient.

TABLE 3.—*Physicians' and Patients' Evaluation of Caudal Anesthesia with Mepivacaine*

	Number	*Per Cent*
Physician Opinion		
Excellent	1,180	97.7
Good	19	1.6
Fair	9	0.7
Total	1,208	100.0
Patient Opinion		
Excellent	1,136	94.0
Good	44	3.7
Fair	18	1.5
Disliked	10	0.8
Total	1,208	100.0

Conclusions

Caudal anesthesia with mepivacaine for obstetrics proved safe and effective in this series. A 1 per cent concentration in Ringer's solution is preferred for routine use, as a 1.5 per cent concentration provides little increase in duration with greater theoretical risk of toxic reaction from increased milligram dosage.

GENERIC AND TRADE NAMES OF DRUGS

Mepivacaine—*Carbocaine.*
Meperidine—*Demerol.*

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